the capacitor

CDE

CORNELL-DUBILIER ELECTRONICS DIVISION
FEDERAL PACIFIC ELECTRIC COMPANY
SOUTH PLAINFIELD NEW JERSEY

VOLUME 25 - NO. 5 SEPTEMBER - OCTOBER 1960

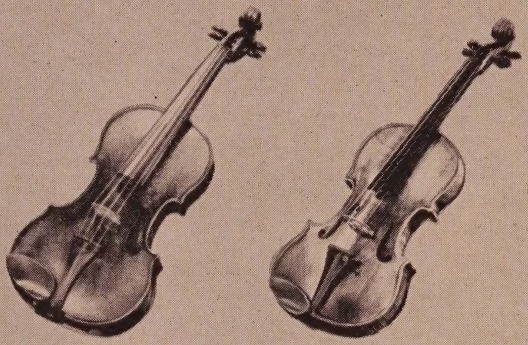
POSTMASTER: If undeliverable for any reason, notify stating reason, on Form 3547 postage for which is guaranteed.

Sec. 34.66 P.L.&R.
U. S. POSTAGE
PAID
So. Plainfield, N. J.
Permit No. 1

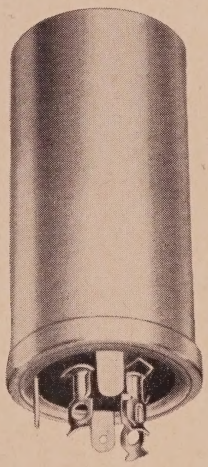
MR.W.E.HILLIARD
PENN ALLEN RADIO SHOP
438 ALLEN ST.
ALLENTOWN,PA.

50th Anniversary 1910-1960

They May Look Alike...



But what a difference!



It's the same with capacitors. Others may look like C-D twist-prong electrolytics, but only C-D's have the built-in extras that are the result of 50 years of capacitor leadership. Next time you buy capacitors, insist on performance. Insist on C-D... *by name!*

TWIST-PRONG BASE ELECTROLYTICS

Furnished with bakelite and metal mounting washers, these small, round-can units are available in single, double, triple and quadruple sections and over 700 different capacity/voltage combinations.

There are more C-D Capacitors in use today by far — than any other make.

Don't gamble — specify C-D

CDE **CORNELL-DUBILIER CAPACITORS**

Copyright, 1960. Cornell-Dubilier Electric Corporation.

Q-MEASUREMENT METHODS

When an a-c voltage (E) is applied to a pure resistance (R), the alternating current (I) which flows through R is in phase with the voltage and, by Ohm's Law, is equal to E/R. When E is applied to a pure reactance (X), $I = E/X$, but is out of phase with E. The phase is leading in a capacitive reactance (X_c) and is lagging in an inductive reactance (X_L).

Since neither pure resistance nor pure reactance exists in reality, but each unavoidably contains an amount (however small) of the other, a practical resistor exhibits some reactance, and a practical capacitor or inductor some resistance. The alternating current through a capacitor or inductor consequently has two parts, a resistive component and a reactive component, and is equal to the vector sum of the two. Reactance in resistors is not our concern here.

In electronic circuits, capacitors and inductors are employed for their reactive action. Any resistance inherent in these devices constitutes a defect, since the resistive current component results in a power component (I^2R) representing a loss and evidenced in heat generation, impaired selectivity, inefficient coupling, etc. High-quality capacitors and inductors are designed and fabricated to keep R low with respect to X. What we refer to is **a-c resistance,** not d-c resistance.

We must pause here to clarify the concept of a-c resistance, Rac. This is something quite apart from reactance (which the student sometimes finds convenient to think of as a kind of a-c resistance). It is definitely a resistance, since current flows through it in phase with applied voltage, whereas current is always out of phase in a reactance. It is not always the same as the d-c resistance, R_{dc}, of a component. Thus, an inductor (coil) might have a certain d-c resistance which is easily measured with an ohmmeter or bridge. And at low frequencies, R_{ac} **might have** the same value as R_{dc}. But at high frequencies, the a-c resistance may be many times higher than the d-c resistance. What, then, determines R_{ac}? Numerous factors are involved. One is the d-c resistance. Others include losses in a coil and dielectric leagage in a capacitor; resistance of leads, terminals, wire, and foils (or other plates); skin effect; losses in coil forms and capacitor encapsulations; effects of coil shields; and corona losses at high voltages. All of these factors are more pronounced in their effects at high frequencies. A significant fact to keep in mind is that there is no simple, direct way to measure a-c resistance in the way that we can measure d-c resistance.

Nature of Q

The foregoing discussion should make it clear that the job of a capacitor or coil is to provide reactance and, in the process, introduce as little resistance as practicable. Very logically then, an indication of its merit is the ratio of reactance to resistance:

(1) $Q = X/R$. Where X and R are in ohms.

Q has no official name, but is sometimes called the **quality factor** or **figure of merit.** The higher the Q, the better the capacitor or coil.

Since R_{ac} cannot be measured directly with any degree of reliability, several methods of measuring Q have been devised and are in wide use. Since reactance is more easily determined (from impedance measurements), R_{ac} may be calculated from $R = X/Q$.

Rewriting Equation (1) for the specific cases of capacitors and inductors, we see that

For Capacitors:

$$(2)\quad Q = \frac{1}{\frac{6.28fC}{R}} = 1/(6.28fCR).$$

Where f is in cycles, C in farads, and R in ohms.

For Coils:

(3) $Q = X/R = (6.28fL)/R.$
Where f is in cycles, L in henries, and R in ohms.

It is apparent, since f appears in the Q formulas, that Q varies with frequency. Thus, what is a high Q at one frequency is not necessarily so at another frequency. It is important, therefore, always to state the frequency at which a Q value has been determined. Over a narrow frequency band, Q will be fairly constant.

Q Measurement

The three common methods of Q measurement are: (1) Susceptance variation method, (2) Q-voltmeter method, and (3) bridge method. Whereas theoretically either method may be employed at any frequency, practical considerations usually limit Methods 1 and 2 to radio frequencies, but Method 3 may be used at either audio or radio frequencies if suitable bridges are available. Methods 1 and 2 are based upon tuned-circuit selectivity. (A high-Q circuit is sharp-tuning, and vice versa.) Method 3 is based upon separate bridge balances for reactance and resistance and a calculation of Q from X and R.

Susceptance Variation Method

This is the method most often employed for occasional Q measurements by students, amateurs, experimenters, and others who do not have access to a commercial Q-meter. Its virtue is that it requires only a signal generator and r-f vacuum-tube voltmeter (and in one version, a calibrated variable capacitor), instruments which are available in any laboratory and may be easily brought together on the bench.

There are two variations of this method: (1) variable-frequency scheme, and (2) variable-capacitance scheme. The latter affords better accuracy but requires a precision variable capacitor whose dial is direct-reading in micromicrofarads. With either scheme, the r-f signal generator must provide a constant output, and the coupling between the generator and test circuit (i.e., between L_1 and L_2 in Figures 1 and 2) must be constant (to prevent fluctuations in r-f voltage) and loose (to prevent electronic backlash). The v-t voltmeter must have a high-impedance r-f input circuit, otherwise its loading effects will mask small Q increments.

Variable-Frequency Scheme. See Figure 1(A) for the test setup. Here, the Q-test circuit is comprised of L_2 and C. If the Q of the capacitor is being checked, L_2 must be a very-high-Q coil. If the Q of the coil is being checked, C must be an air capacitor. L_2 and C must resonate at the desired test frequency (f): $C = 25{,}400/f^2L$, or $L = 25{,}400/f^2C$; where C is in $\mu\mu$fd, L in μh, and f in Mc. The signal generator is link-coupled to the test circuit through a 1- or 2-turn, solidly-mounted coil, L_1.

To check Q with this setup: (1) Tune the generator, to resonate the test circuit, for peak deflection of the vtvm. The resonant frequency is f_2 in Figure 1(B). (2) Record this meter reading (E in Figure 1B) and this frequency (f_2 in Figure 1B). (3) Detune the generator above the resonant frequency to a point at which the deflection drops to 0.707E. (4) Record this frequency (f_3). (5) Detune the generator below the resonant frequency to a point at which the deflection again drops to 0.707E. (6) Record this frequency (f_1). (7) Calculate Q:

$$(4)\quad Q = f_2/(f_3-f_1)$$

The figure obtained from this calculation is the Q of the circuit, L_2C. If

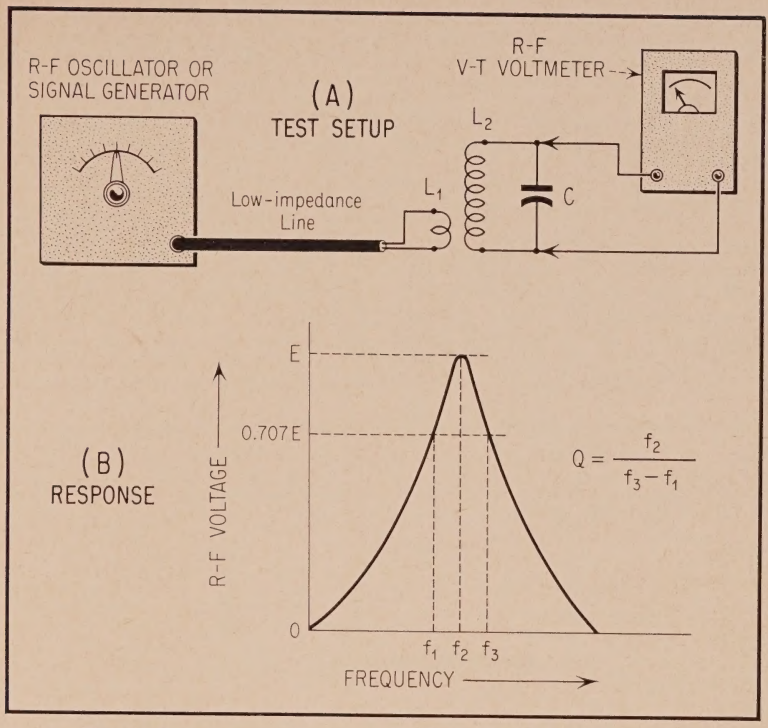


Fig. 1. Susceptance Variation Method, Variable Frequency.

a coil is under test, a clean, dry, air capacitor (at least 100 $\mu\mu$fd) is used for C. The Q of such a capacitor is very high and the calculated value may be assumed to be the Q of the coil. If a capacitor is being checked, Q_L of the coil (L_2) must have been determined in a previous measurement. The capacitor Q then may be determined in terms of Q_L and Q_O (the measured Q of the circuit):

$$(5)\quad Q_O = \frac{1}{\frac{1}{Q_O} - \frac{1}{Q_L}}$$

Variable-Capacitance Scheme. Figure 2(A) shows the test setup. This scheme is employed chiefly for checking the Q of coils. It requires a precision variable capacitor C (which has a calibrated dial reading direct in micromicrofarads). For versatility and a wide range of measurement, the maximum capacitance of this unit should be at least 500 $\mu\mu$fd.

To check Q with this setup: (1) Set the signal generator to the desired test frequency. (2) To resonate the test circuit, tune the variable capacitor, C, for peak deflection of the vtvm. (3) Record this voltage deflection (E in Figure 2B) and this capacitance setting of the variable capacitor (C_2 in Figure 2B). (4) Detune the capacitor to a point above the resonant ca-

pacitance, at which the deflection drops to 0.707E. (5) Record this new capacitance (C_3). (6) Detune the capacitor to a point below the resonant capacitance, at which the deflection again drops to 0.707E. (7) Record this capacitance (C_1). (8) Calculate Q:

(6) $Q = C_2/(C_3-C_1)$

Characteristics of the Susceptance Variation Method. The accuracy of this method depends upon several factors.

First, for high Q values, the f_3-f_1 increment in the variable-frequency scheme and the C_3-C_1 increment in the variable-capacitance scheme are very small. It may not be possible to read such a small frequency difference on the dial scale of the average r-f signal generator with desired accuracy. The dials of precision capacitors may be read quite closely, however, and this makes the variable-capacitance scheme significantly more accurate.

Secondly, the signal generator and v-t voltmeter must have better than average stability. And the coupling between L_1 and L_2 must be loose and constant. Moreover, **all** connections must be short, direct, and solid, and the Q-test circuit (L_2C) must be supported clear of metallic and nonmetallic objects. Any insulating materials used in the construction or support of

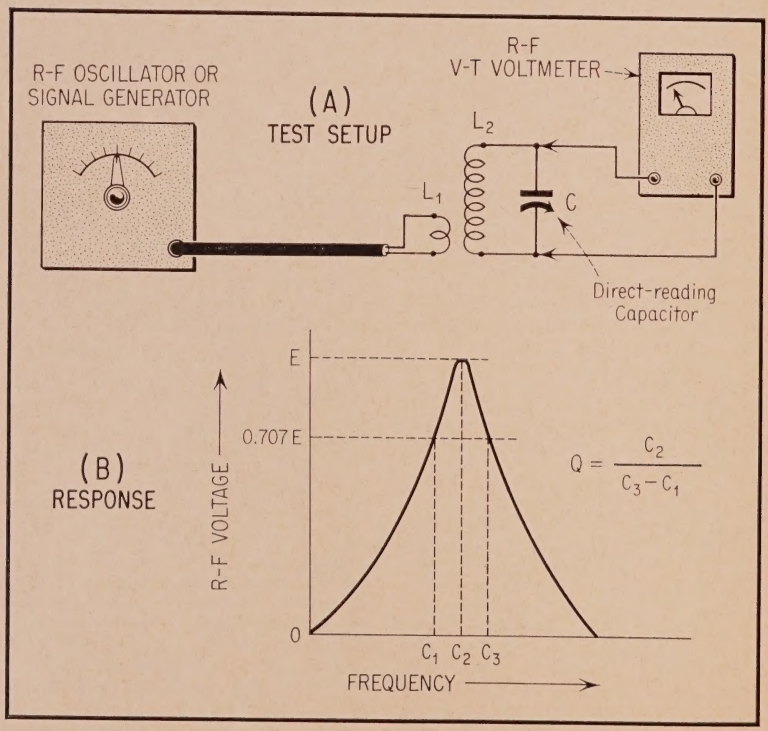


Fig. 2. Susceptance Variation Method, Variable Capacitance.

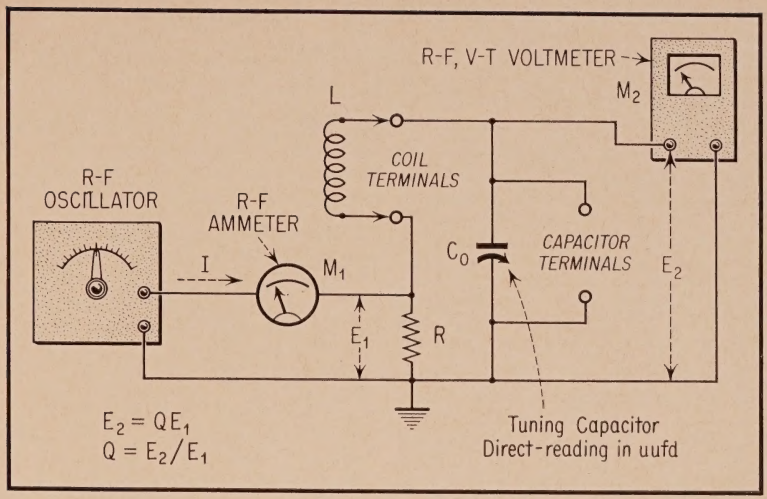


Fig. 3. Q-Voltmeter Method.

the test circuit must be of superior grade (high-Q, low power factor) and both clean and dry. If these precautions are not taken, variations in deflection and Q-masking will render the measurements useless.

Thirdly, this method of measurement is successful only when the r-f input impedance of the v-t voltmeter is very high and the input capacitance low. Since the vtvm input is across the test circuit, it can cause considerable Q-reduction unless this instrument is itself high-Q.

If these various factors are not taken into consideration, the susceptance variation method will be unfit for absolute measurements and will give only rough comparisons.

It is very difficult to calibrate the vtvm scale for direct Q readings when the susceptance variation method is used. Although some ingenious schemes have been devised, most of them entail numerous auxiliary adjustments and checking steps which hardly discourage lengthy Q calculations.

Q-Voltmeter Method

The Q-voltmeter method is employed in commercial Q-meters. It has many features which recommend it for permanent instruments, but it can be used also in temporary bench setups.

Figure 3 shows the test setup. In this arrangement, the oscillator develops a radio-frequency voltage (E_1) across a very low noninductive resistance (R). This voltage is applied to L and C_o in series. The dial of the variable capacitor, C_o, is direct-reading in micromicrofarads. A coil to be tested is connected to the COIL TERMINALS; a capacitor to be tested is connected to the CAPACITOR TERMINALS. When a capacitor is under test, L is a suitable high-Q coil for resonating to the test frequency. The r-f ammeter (M_1) indicates the current flowing into the test circuit, principally into Resistor R, and is used for reference purposes in setting the r-f input to a predetermined level. The generator must be capable of delivering enough power to develop the reference voltage across R which is less

than 0.1 ohm. M_2 is an r-f vacuum-tube voltmeter which reads the voltage (E_2) developed across C_0. This instrument must have very high input impedance, so that its loading of the test circuit will be negligible.

In this circuit, the applied voltage (E_1) is stepped-up Q times by the series resonant test circuit. Thus $E_2 = QE_1$. If E_1 is maintained (by adjustment of the oscillator output) to a predetermined reference value, indicated by a line graduation on the scale of M_1, the scale of M_2 may be graduated directly in Q units. This is one advantage of the Q-voltmeter method.

Checking Q of Coil. (1) Connect the coil under test to the COIL TERMINALS, using short, rigid leads. (2) Set the generator to the desired test frequency. (3) Set the generator output to the reference level, as indicated by M_1. (4) Adjust the variable capacitor (C_0) for resonance, as indicated by peak deflection of M_2. (5) Read Q directly from the M_2 dial. (6) If M_2 is not Q-calibrated, calculate $Q = E_2/IR$.

Checking Q of Capacitor. (1) Plug a suitable high-Q standard coil into the COIL TERMINALS. (2) Set C_0 near the top of its capacitance range. (3) Record this setting as C_1. (4) Set the generator to resonate the test circuit, as indicated by peak deflection of M_2. (5) Set the generator output to deflect M_1 to the reference level, and retune the generator for resonance, if necessary. (6) Note the Q reading on the scale of M_2 (or calculate $Q = E_2/IR$) and record this value as Q_1. (7) Connect the capacitor under test to the CAPACITOR TERMINALS. (8) Retune C_0 to restore peak deflection. (9) Record the new setting of the variable capacitor as C_2. (10) Record the new Q-reading from M_2 as Q_2. (11) Calculate true Q of the capacitor:

$$(7) \quad Q_C = \frac{(C_1 - C_2)(Q_1 Q_2)}{C_1 (Q_1 - Q_2)}$$

Bridge Method

A radio-frequency bridge is similar to the more common low-frequency bridge, except that extensive shielding is employed in the arms of the former, and stray reactances are greatly minimized in the r-f instrument. The r-f bridge has separate balances for resistance and reactance and each of these controls is provided with a dial which is either direct-reading in ohms or requires very little calculation to obtain R and X values.

The bridge is energized by a suitable r-f signal generator and employs a radio receiver or sensitive r-f v-t voltmeter as the null detector. With the test capacitor or coil connected to the UNKNOWN terminals, the bridge is balanced separately for reactance (X) and resistance (R). The Q of the component under test then may be calculated from these values. Thus: $Q = X/R$. A capacitor or coil may be checked for a-c resistance with a standard bridge operated at low frequency (1000 cps or lower), the reactance calculated from the measured capacitance or inductance, and Q determined from X and R as explained above.

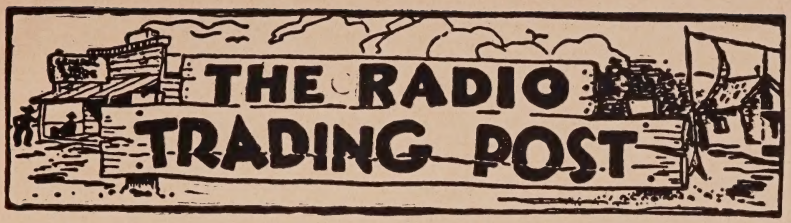
Estimating Low-Frequency Q

The low-frequency Q of an iron-core coil may be estimated roughly from a series of simple measurements: (1) Apply a known a-c voltage (E) to the coil and measure the resulting current (I). The impedance of the coil at this frequency is equal to E/I. (2) Measure the d-c resistance (R) of the coil. (3) Calculate the Q of the coil:

$$(8) \quad Q = \frac{\sqrt{(E/I)^2 - R^2}}{R}$$

Where E is in volts, I in amperes, and R in ohms

This method assumes that the a-c resistance of the coil at low frequencies, such as 60 cps, has the same value as the measured d-c resistance.



This CORNELL - DUBILIER Advertising Service is FREE to "Capacitor" readers. If there is anything of general interest or appeal in the line of electronic equipment or service that you want to BUY — SELL — or SWAP . . . if you want a job or need help, these columns are at your service.

Please PRINT or TYPE your Ad clearly and limit it to 40 words including your name and address. Because of space limitations — only one Ad at a time — please.

Ads are published in the order received and as space permits.

CORNELL-DUBILIER ELECTRIC CORP. reserves the right to edit your Ad to conform to its policies and is the final judge of its suitability for publication. We do not assume any liability or responsibility for any transaction that results. Make your deal direct with the advertiser listed in the Ad.

If you have a "CHANGE OF ADDRESS" — give both your OLD and NEW and mark your request "For C-D Capacitor Mailing List."

IF YOU ARE RECEIVING DUPLICATE COPIES FOR WHICH YOU HAVE NO USE, PLEASE ADVISE YOUR LETTER CARRIER STATING — "DUPLICATE — NOT WANTED".

WANTED — US stamps & first day covers, mint blocks or used. Will pay cash or swap radio quip. Ralph Ernstein, 6124 Teesdale, N. Hollywood, Calif.

WANTED — Kennedy 281 or antique radios such as Radiola I, Westinghouse Aeriola, Jr., crystal set, any commercially made crystal set for cash or trade like new Leica. Paul Giganti, 2429 San Carlos Ave., San Carlos, Calif.

For Sale — Citizens Band xceiver modulation xformer, Thordarson 21M55, $4 pp. Bronson Spinning Reel, $5, Riders Radio Manuals, $2.50 ea. D. L. Turner, 2019 Sherman St., Anderson, Indiana.

WANTED — BC-603 & BC-683 surp. rcvrs & others that will tune from 140 to 150mc. All gd cond. Lovett Radio & TV Service, Box 143, Newland, N. C.

FOR SALE — 24" 630 TV chas. comp. with tubes, masks, etc., less 24CP4, $22; Westinghouse 12" table TV $15; Zenith TV chassis $5; GI 90 disc rec. $15. J. Eastwood 868 Center Dr., Franklin Sq., Long Island, N. Y.

FOR SALE — Sams 1 to 245 in binders, Precision E-200C sig. gen., 845 dual sensitivity multi tester, Superior cross-bar gen., 670A super meter, Stancor 1-15v batt. elim. South Side Electronics, 257 Floral Ave., Johnson City, N. Y.

FOR SALE — Heath DX40 xmtr 5 mos. old, vy. gd. cond., carefully wired, final tube is new, $55. Regent Radio, 920 W. Erie Ave., Phila. 40, Pa.

SELL OR SWAP — Bell & Howell 16mm camera, f2.5 lens, mag. load for ham equip, test equip. or $75. A. Ringel 3868 Tilden Ave., Culver City, Calif.

FOR SALE — 2 Class B Citizens handitalkies vy. gd. cond.; 465mc Stewart-Warner. Best offer. Tom Kneitel, 97-10 62nd Dr., Rego Park 74, N.Y.

FOR SALE — Gonset comm. 11-B, 2 meter rcvr-xmtr, $135. Gene Johnson, 3 Washington Pl., Cranford, N. J.

FOR SALE — NC183D looks and works like new, $310; pair BC 645A xvrs can be converted to Citizens Band $45 for pr. Thomas J. Sulas, 5808 — 80th St., Elmhurst 73, N. Y.

WANTED for safety work — General Radio vibration meter, either type. Must have calibration curves for all 3 ranges of accelleration, etc., vibration head slow, medium and static. Will trade A-1 lab. equip., tubes — special purpose or what you need? Bob Eubank, 1227 Windsor Ave., Richmond 27, Va.

SWAP OR SELL — Two JRC-400 Vocaline xcvrs comp. with aerials, cables for 117v AC and 6 & 12v DC, mikes for both. Sell for $60 or swap for late mod. xcvr for new Citizens Band or 27mc. John Arnold, Wilson St., Bluffs 3, Ill.

SERVICE — Kits built — Send kit (not tampered with) and 15% of cost or cost of kit plus 20%, and I will order. Assembled units rushed collect, express. One week delivery. Art's Radio and TV Shop, 8 Savoy Rd., Salem, Mass.

WANTED — National tuner, state price & cond. Kraft, Box 60, Planetarium Station, New York 24, New York.

FOR SALE — 90 Harvey Wells xmtr with matching pwr sup., AC, 80 thru 10 meters. Built in VFO or xtal, $100, bandmaster to match $50. N. DeRobertis 1115 - 6th St., North Bergen, N. J.

FOR SALE — 600v-200ma pwr sup. comp.: 2 oil filled 1000v cond. 5HY-500ma choke, 60k-200w bleeder plus 6.3v at 8a fill xfmr $25. Local only. George Lhota, 4240 Warren Ct., Cleveland 27, Ohio.

SPECIAL HI-FI CHASSIS DEAL — Top brand 17 tube Hi-Fi AM-FM tuner, comp. with 50w stereo amps., factory closeout, comp., ready to install in cabinet, $70 ea., 3 for $200. Bell Park TV, 241-21 Braddock Ave., Bellerose, L. I., N.Y.

FOR SALE — Pwr. supply items to operate BC 603 or 683 rec.; xformers 300-0-300v 117 AC 5v & 6v windings, Chokes & 8 x 8 MF 450v condensers, wirewound resistors 25w adj. 5000 ohms, also female Jones plugs No. 18. Comp. with box to mount parts in, $12 ea. Jos. Murray, 12 Adams St., Charlestown 29, Mass.

FOR SALE — 200w RF amp. for 220-225mc comp. shielded, with 4 x 250 M tetrode & blower. Needs 8w drive & 800v at 250ma. 110w output for $39. Bill Blair, 801 Munevar Rd., Cardiff, Calif.

FOR SALE — Tubes from OD3 to 2051. Must clean out stock. Will ship pp. All tubes checked on new Hickok 6000 before shipping. Roy W. Randall, Rt 1., Bridge Rd., Hobe Sound, Fla.

URGENTLY NEEDED — Inst. manual &/or schematic for BC 1206-C Beacon rcvr made by Setchel Carlsen 195-420kc. State Pr. Christie Urback, 3145 Salmon St., Philadelphia 34, Pa.

TRADE OR SELL — Bolex 8mm camera & B&H Regent proj., Hi-Fi equip., tape rec., pair of flintlock or percussion duellers,, etc. John J Custer, 44-55 Kissena Blvd., Flushing 55, N. Y.

COLLECTORS ITEMS — Best offer, one ea. DeForest audio-White isolantile base, date of mfg. approx. 1919; Radiotron: WD-12, WX-12, UV-200, UV-201A, UV-199, UV-202 & Raytheon X-99. Williamson Radio Serv., 631 W. Dallas, Cooper, Tex.

SELL — Mobile Vibrator pwr supply, James Dual 1050, fact. wired, like new, $30; 10 meter Morrow gen hash filter, $3, noise suppression items, 6v DC, DPDT ant. changeover relay, $4, 0-500 Westinghouse DC milliamp. meter, $8. A. L. Jeffrey, 1321 Brinton Rd., Pittsburgh 21, Pa.

FOR SALE — Eleven 700 decimal counting units mfgd. by Berkeley Scientific Co.; 5 mod 740 accompanying input amp.; 7 Victoreen 1B85 thyrode counter tubes, All for $75. A. Odabashian, Main St., Glen Gardner, N. J.

FOR SALE — Heathkit 0-10 scope, with RF & low capacity probes, expertly wired, mint cond. throughout $50 firm. Ace Hi TV, 314 Bay 14th Street, Brooklyn, N. Y.

FOR SALE — B&K CRT Checker 350, $20, Eico 315 sig. gen. $20; Aerovox LC-checker 97, $35; Century in-circuit cond. checker $15; Simpson 1000 tube tester, $40; Seco FB-4 flyback checker $20. Harold Kroll, Box 115, Seymour, Wisconsin.

FOR SALE — Receiver 453B, 200 to 550kc, $4.50. A. C. Scofield, 119 S. 23rd St., LaCrosse Wis.

WANTED — Closed circuit TV systems & TV broadcast equip of all types. W. A. Goddard, Massey Tech. Inst., Jacksonville 6, Florida.

FOR SALE — National NC-46 rcvr, $35; Heathkit QF-1 Q multiplier, $11. Will trade for 5" scope. E. J. Wolitzer, 2143 — 82nd St., Brooklyn 14, N.Y.

FOR SALE — Blonder-Tongue 99 UHF conv. like new, in box $7. RCA transcription pickup $1.50; unused Willard 2v batt., dry charged $2. Eric Scholer, 209 Glengary Rd., Schenectady 4, N.Y.

FOR SALE — UTC MLF 20w amp. $60; Stromberg Carlson preamp $40, Williamson 2 chassis amp. using UTC components $50. All three, $125 with 150 MA meter thrown in to check balance. Also Collaro 456 rec. changer. J. Kurland, 75-40 Austin St., Forest Hills 75, N.Y.

FOR SALE — Precision E-200 sig. gen. $35, unused Precision E-400 sweep $80, Heath T-3 tracer $15, RCA 15" speaker (2 lb. magnet) $25, Heath DX-35 xmtr in fine cond. $45; or best offer. Donald Voegele, 5572 Broadway, Lancaster, N. Y.

FOR SALE — Books: Abbot, W. Handbook of Broadcasting, 2nd ed., $1; Nelson & Hornung, Radio Operating, Questions, & Answers, $1; Audel, Radioman's Guide, incl. TV, $3; Hodgman, Ch. D. Math. Tables, $1. All in fair cond. & fob. V. H. Grey, 121 Seville St., Ormond Beach, Fla.

FOR SALE — 10 motor start-stop switches $7.50; 100 Rotary switches, single pole, 3 position $5; 50 Cutler Hammer push button normally closed switches, $5. W. Kalmanson, 80 St. Marks Pl., Staten Island, New York.

FOR SALE — Raytronic beamer, commercial pix tube tester & repairer; comp. with all equip. & instr. $125. Hickok 533 DM dynamic mutual conductance counter type tube tester in good cond. $100. Rose Radio & TV, 15 George St., South River, New Jersey.

FOR SALE — Sams Photofacts: 75, 78, 84, 92, 96, 99, 102, 107, 109, 110, 111, 118, 126, 127, 129, 131, 134, 143, 148, 151, 153, 154, 159, 167, 169, 171, 176, 184, 185, 192, 193, 197, 198. All $40. W. E. Anderson, Bloomsbury, New Jersey.

FOR SALE — 2 meter xmtr, 832A final, xmitter portion of famous 522 plus 6-807W xmtrg tubes, $12 plus ship. charges. J. B. Shinal, 23 Shamrock Ave., Seneca Falls, New York.

SELL OR SWAP — Jackson 648 tube checker, Howard 482 FM tuner, Eico 147 tracer, Knight 1041 Hi-Fi 2 speed recorder. Radio Clinic 845 Allingham St., Van Wert, Ohio.

FOR SALE — Magnecord 816PK tape play back 8 hour, fine cond., $650. UHF Electronics, 1011 E. 31st St., La Grange Pk., Illinois.

FOR SALE — Measurements Corp. 111 crystal calibrator $45; PP813's final, comp. $40; 811's modulator $40; 250w Kenyon T495 mod. xfrmr $20. HV pwr supply for above $40 or this xmtr in cabinet, local, best offer. Dave Overton, 1709 W. 30th, Austin, Texas.

FOR SALE — Atwater-Kent mod. 20 radio rcvr in gd. cond. Carl Kircher, 1802-C Ramblewood Rd., Baltimore 14, Md.

FOR SALE — Like new 0-1 MA meter 4½" sq. bakelite case, VOM scale, knife edge pointer, 50 ohms internal resistance. Usable as replacement in Silver Vomax test unit. Shipped pp. $5. L. Cohen, 151-09 — 34th Ave., Flushing 54, N. Y.

FOR SALE — G. E. AS1B aircraft xcvr with separate G. E. pwr-pack, $25 or best offer. Howard Leffel, 144 W. 70 St., New York 23, N.Y.

TRADE OR SELL — Ten books on Radio & TV, 50c to $1 or trade for sig. tracer. W. Sommers, 500 Ft. Washington Ave., New York, New York.

SELL OR SWAP — Electronic Secretary, automatic phone answering unit, $125; Hycon 615 digital VTVM, $125; RCA audio osc., WA-54A, $35; RCA UHF 710A gen., 370-550mc, $35. Want small 3" scope, Motorola two way equip. J. L. Orysen, 2025 Sunkist Ave., Waukesha, Wisconsin.

FOR SALE — RTTA radio TV course. 118 lessons with math supplement, less kits, $40. Earl Peters, 89 Princewood Ave., Prince's Bay, Staten Island 9, N. Y.

WANTED Job & Used equip. — Need job due to fire loss, six years experience in radio & TV. Will buy tube tester, VTVM & capacitor checker. Elmer L. Mosley, 1609 Pine St., Kenova, W. Va.

WANTED — Hi-Fi speakers, pref. AR-1 & 2. Immed. cash. State pr. Irwin Shuldman, 97-10 62nd Dr., Rego Park 74, N. Y.

WANTED — Pentron CA-13 record-playback preamplifier. State cond., price. John W. Robinson, 222 Marmont St., Culver, Indiana.

FOR SALE — Collins 32V2 Amateur xmtr $225. Heathkit SB10A single sideband adapter with pwr supply $90. Robert Weinstein, 3101 Healy Ave., Far Rockaway 91, New York.

SALE or TRADE — NRI Comm. course with transmitter, $25; Motorola color TV., pic. tube weak, otherwise excellent, $95; Heath computer, $150. All plus shipping. Want good comm. rec., 5 or 7 band. George J. Rupp, 6009 Falkirk Rd., Baltimore; 12, Md.

WANTED — Transfomer T-13 only for PE-110 power supply. H. W. Lingenfelter, 21352 Kenwood Ave., Rocky River (Cleveland 16.) Ohio.

FOR SALE — Riders Manuals in vy. gd. cond., vols. 10 to 22. Make offer. R.W. West, Parker, Ariz.

FOR SALE — General Radio 731B modulation monitor with manual $40; West. Elec. surplus oper. mobile rig 2-12v dynamotors, ant. rlys, keys, etc.; xmtr 3675-4525kc, rcvr 3865-6265kc, both with plug-in coils, steel frame fits trunk shelf, $60. R. Goodwin, 909 Fairfield, Waukegan, Illinois.

SELL OR SWAP — Ampl. 75w RCA M1-12214E with 2 mikes, hi-lo phono jacks with bass & treble cont. Uses 11 tubes (4-1622 outputs). Want $95 or what have you in an AM-FM rcvr? J. Teitler, 9 Target Lane, Levittown, L. I., N.Y.

FOR SALE — Sams Photofacts $1 ea.: Nos. 3, 13, 17, 47, 49, 73, 79, 100, 108, 111, 113, 119, 230 & 316. W. E. Dietz, 37535 5th St. E., Palmdale, Calif.

FOR SALE — Giving up radio hobby: speakers 6"-8"-10"-12"-14" one ea., PM's, Riders manuals 1 to 5, Sams Photofacts 1 to 10 in binder. Sell very cheap. Many other items. M. J. Difini, 358 Esplanade, Apt. 56, Hackensack, N. J.

SELL OR SWAP — Press wireless, FS xmtr monitor, AL-2 line amp., HPF-1 moduplex filter. Al Denson, Box 122, Rockville, Conn.

FOR SALE — Supreme 666 signal generator $50. Roy W. Bennett, Box 273, Coloma, Michigan.

SELL — BC221AA freq. meter, $40; Heathkit AM2 reflected pwr & SWR Bridge $8; Simpson 260, $20; B&W 600 grid meter, $20; Precision EV-20 VTVM & RF prob RF-10A, $25. Mrs. Robert Besser, 507 Walker, Sturgis, Mich.

FOR SALE — All Precision made: scope ES 520 with test probe SP-5; Vacuum tube multi master EV-10A with hi-frequency and hi-voltage multiplier probes; signal generator E-200 C; Tube tester 10-12, with picture adapter. V. Garcia, 499 W. 135 St., New York 31, N. Y.

WANTED — 6B5 or 6N6 tubes. State pr. & no. M. A. Porter, 4930 N. Pulaski Rd., Chicago 30, Ill.

FOR SALE — VFO 755 by WRL factory w/t $40; Globe Scout 65A $55. Both in fine cond. C. Stouth, 261 Prince Frederick Rd., King of Prussia, Pa.

SELL OR SWAP — GR, VTVM 726 Westinghouse freq. dev. meter HU-1 & hetrodyne freq., Meter HM-3, & Browning syncro scope P4E. Al Denson, Box 122, Rockville, Conneticut.

WANTED — Basic &/or advanced text or course on Single Side Band theory. E. L. Williams, VP-6, c/o FPO, San Francisco, California.

WANTED — Sig. gen., RF Wattmeters, Barretter bridges & other laboratory-quality items; Klystron tubes, manuals, inst.. Cash or swap. Charles Littell, Jr., 434 Patterson Rd., Dayton 19, Ohio.

FOR SALE — RCA 61B color bar gen. $259.50 & 46A dot gen. $179.50. Both like new & both for $249. Quincy Gibbon, Highway 82W & Clay St., Greenville, Mississippi.

FOR SALE — Motek (British made) tape deck Monaural, 3 motors for 115v DC or AC, in original unopened ship. carton, $40. Will ship pp. W. A. Toepel, 70 Washington Ave., West Caldwell, N. J.

SWAP — For good comm rcvr. Many units of radio components incl. NRI scope; Heath W5M amp; AC instructograph with osc & tapes; Industrial Industries Co. L2aU insulation resistance tester. D. Gottesman, 1711 Mohican St., Philadelphia 38, Pennsyvania.

FOR SALE — 3 Vis-U-All auto radio serv. Merchandisers, Used very little, gd cond. $80 ea., 3 for $225. Ed Wank TV Serv. Co., 378 E. 200th St., Euclid 19, Ohio.

FOR SALE — RCA Electronics for Automation correspondence course. Gerard A. Baldauf, 102 Madison Ave., Hyde Pk., Reading, Pa.

FOR SALE — Two Apache xmitrs & mobile Gonset G77 with pwr supply, both perf. 2 fixed freq. rcvrs Collins, National for 2-24 Mc. Cheap. R. Cook, 4118 Tracy St., Los Angeles 27, Calif.

SELL OR TRADE — 6 & 12v alternators, motordriven 1000w powerstats, meters, Sams etc. List on req. Need Lampkin freq. meter or equiv., Leica Telephoto lens, 2¼ x 3¼ Graphic, Citizen Band equip. Al Bollman, Liberty Center, Ohio.

WANTED — Cabinet for Emerson 508 radio & S-meter for National 173 rcvr. Philip Krayniak, 3636 Willett Ave., Bronx 67, New York.

FOR SALE — Magazines: Radio Electronics May '57 to Dec. '58; Radio-TV News Feb. '54 to Jan. '57 (less four issues); best offer. Don Honig, 789 Coney Island Ave., Brooklyn 18, N. Y.

WANTED — BC 348 Communications Receiver or Lafayette KT-200 in good working condition. William Moroney, 59-41 69 Place, Maspeth 78, N. Y.

FOR SALE — Canary Tape Recorder, Dual Speed; Dual Track; 3¾ and 7½ ips, complete with Mike, Tape and Reels. Perfect condition, Weighs 16 lbs., $69.50 FOB Hudson, N. Y. Fred Keller. Memory Lane, Linlithgo, N. Y.

FOR SALE — 100 watt rack and panel (813) home-brew rig, VFO, and 2-element 2-band beam with Alliance rotator; spare tubes; Heath Mohawk receiver, speaker, and manuals, never used. Best offer. Mort Rosen, 1530 E. 27th St., Brooklyn 29, N. Y.

FOR SALE — Kodak Medalist Mk 1 Press Camera, $35. Will consider trade for Audio Generator. Local only. Ray Langlois, 11360 Segrell Way, Culver City, California.

WANTED — Instruction Manual for Hickok 195 Scope. State Price. W. H. Maull, 1705 South 24th St., Phila. 45, Pa.

FOR SALE — Auto Radios in A-1 cond.; Chev. 49-52, Ford 50-53, Plym. 50-52, Mercury 52-54, Dodge 50-54. Each $25, others at low prices. A-1 TV Service, 1198 Haddon Ave., Camden 3, N. J.

WANTED — Willard storage battery type ER64B 4 volts, used or shelf worn. Pair of old 00-A tubes. Must check out good. John Chesnik, 2912 E. 123 St., Cleveland 20, Ohio.

FOR SALE — Eico 720 amateur transmitter, 90 watts, fine cond., $65. August Beza, 121 Bay 17th St., Brooklyn 14, N. Y.

FOR SALE — Hickok 600A Mutual Conductance tube tester, used only one month $125. Paul Rakyta, 48 High St., Torrington, Conn.

FOR SALE — BB1-A David Bogen VHF booster, good operating cond. Best offer. Thurston TV Service, US 33 N, RR3, Fort Wayne, Indiana.

FOR SALE — Simpson 480 Genescope, Sweep-Marker Generator, good cond., $175 cash. Valobal, 3201 So. 73rd St., Omaha 14, Neb.

FOR SALE — Allied 18W Hi-Fi amplifier, in fine cond., 1 year old, $30. Free delivery within 300 miles of N.Y.C. Arthur H. Ruder, 1317 East 31st St., Brooklyn 10, N. Y.

WANTED — BC-453. State price and cond. John Waskowitz, 541 Marcy Ave., Brooklyn 6, New York.

TRADE — 60mm refractor telescope, 6" reflector mirror. Unused set of code records. Want Hammarlund crystal frequency standard, International crystal FO-200, grid dip meter; 3" Heath scope. Theodore Nadeje, 5101-AA 39th Ave., Sunnyside 4, N. Y.

WANTED — Moderately priced communications receiver in good working order. D. McCarthy, 865 Main St., So. Glastonbury, Connecticut.

WILL SELL — Knight cap. chkr. $10; 260 Simpson, $30; GE 250w batt., $35; Super Pro $50; 954 Precision $45; E-100 VTVM $30; E-200 $65; E-400 $79.95; Hickok 288 gen. $125. J. Pellock, 715 N. 7th, Benld, Illinois.

SELL or TRADE — 16" Magnavox console TV, 96" Mobile-whip with base for 50w. transmitter or photo enlarger or photo equip. Prefer local. Write for info. Scott Wood, 209 Woodcrest Rd., Media, Pennsylvania.

WANTED — All types of Heath test equip. and Hi-Fi equip., Sams Photofact folders over 250, Supreme and teleaide books, Sencore and other service aids. R. Herin, 714 W. 51 Pl., Hialeah, Fla.

WANTED — Recent used or incompleted home study communications course. R. Gerrish, 15 Arch St., Dover, N. J.

TRADE — Transistors, diodes, used tubes, and parts. Want old books on radio, baseball, football, and antique radio parts. John Haynes, Doe Run, Mo.

TRADE — Superior TV-40 CRT tube tester for Heathkit T4 signal tracer or other late make; Triplett VOM 666H $10. J. Kozma, 12450 N.W. 5 Ave., Miami 68, Florida.

FOR SALE — Garrard T with base, 45 rpm not working, unused GE cartridge and 1 mil diamond, $20 FOB. Edward G. Videika, 33-40 89th St., Jackson Hgts. 72, New York.

FOR SALE — 3 speed phonograph like new, $19. Don Hurlburt, 541 Georgia St., Vallejo, Calif.

FOR SALE — Diagram of deflection tester and substitution instrument containing own CRT, osc's and outputs, diagrams available $2.50 ea. P.P. Vale Radio & TV Service, Box 491, Vale, Ore.

WANTED — Cash and/or trade for test equipment: GE Halogen leak detector H-1, H-5, H-6 complete. Have wide assortment of tube, testers, scopes, Dot-Bars, sig. generators. G. E. Howarth, 316 1st Ave. East, Oskaloosa, Iowa.

FOR SALE — National NC-300 amateur receiver in very good cond., $200 and 6 meter converter for above, $25. Both for $220 or make offer. Jerry Copeland, 1760 First Ave., Walnut Creek, Calif.

WANTED TO BUY — Correspondence courses in Computer Programming, Radio-TV, Electronics, Mathematics, or what have you? Write giving price, and cond. Ray Taylor, 6672 Humboldt Ave., Westminster, Calif.

FOR SALE — Approved Electronic Instrument Corp. A-470 TV Linearity Pattern Generator, crystal controlled, perfect condition. Best price takes it. A. Hawkes, 10 Hardy Rd., Westbrook, Maine.

TRADE — Surplus equipment and parts for testing instruments. A/2c Araujo, Joaquin, A., Box 2011, James Connally A.F.B., Waco, Tex.

SELL or TRADE — Rare phono records. George M. Cohan, Louis Armstrong, King Oliver, Mae West, Bill Robinson — all originals, hundreds of others. Want good short wave receiver or TV-set. Fred Simonian, 25 Smith St., Lynn, Mass.

SELL or TRADE — Collins 32V-3, 75A-1, 4D32 tubes, misc. still and movie equip., Crossman 150 Pellgun. Want small electric organ, metal lathe, oxy-acetylene welding equip. Hilary Burton, Suite A, Lane Plaza, 250 Governor's Dr. SE, Huntsville, Ala.

FOR SALE — Two "Mark" army surplus T/R units with 12/24v dynamotors, & controls, mikes, headphones, etc., two band, $25 each, Weston analyzer $25; 6 volt batt. elim.-charger $15. J. A. Hauser, 62 Broad St., Albany 2, N. Y.

FOR SALE — books: Modern Oscilloscopes and Their Uses by J. H. Ruiter, $4; Encyclopedia on Cathode-Ray Oscilloscopes and Their Uses by Rider and Uslan $9. O. F. Hamm, 4751 Louisiana, St. Louis 11, Missouri.

WILL TRADE — Terado inverter, 6 or 12v dc input, 110v ac output, for suitable Hi-Fi equip, tape recorder or cash. Geo. Ledoux, 63 North Washington St., Plainville, Connecticut.

FOR SALE — Hickok 209A VTVM like new, with instruction book & probes. No reasonable offer refused, 9" chrome meter. Gorge Greenberg, 821 Porter St., Philadelphia 48, Pa.

SELL or TRADE — Eico 221 VTVM, good working condition. Want 12" or 16" Jig Saw. Send stamp for list of radio, TV, Hi-Fi, test equip, parts & accessories. Alexander Podstepny, 1652 Dounton St., Phila. 40, Pa.

SELL or TRADE — Filament tube tester SM-101 $5; set of 32-volume NRI elec. course, good cond, $50 or swap for something of equal value. Walter W. Nelson, Rt 2, Box 65-A, Meherrin, Va.

WANTED — Electro-magnet 12" speaker No. 4045 G18 1100 ohm coil in good cond, for Philco radio 42-390. Joe Csuti, 133 Nutwood Ave., Middlesex, N. J.

FOR SALE — NRI-Radio - TV Servicing course, $15, Postpaid. Raymond Kotch, 2512 Amelia Ave., Scranton 9, Pa.

FOR SALE — Globe King 500C $595. GDR heavy duty ham rotator $95, both like new; audio amp and 400w modulator complete $100; 125 w 2 meter xmitter $65; 10 & 20 meter final ½kw & supplies $95. T. Azzara, 13 Shepard Pl., Nutley, N. J.

FOR SALE — Pentron 549 Tape Recorder, good condition, best offer. Galen Stutzman, 450 Hibiscus Lan, Dunedin, Fla.

FOR SALE — Eico 315 signal generator $25; Dumont 208 scope $49; Ampro 730 tape recorder, single speed, dual track, $39. All FOB H. Bell, 3917 Ely Ave., Bronx 66, N. Y.

SELL or TRADE — CBS home transistor course $10; Eico Cap., Comparator Bridge 950A, $10; Genometer TV50 $27; Electro-Voice UHF Converter $12; four 2N278 $3 each. All like new, postpaid. Need 6 meter gear. John Gerbi, Great Rd., Littleton, Mass.

WANTED — Instruction manual and/or schematic for Aireon Kansas City 1221A amp. Bernard Serota, 2502 S. Phillip St., Philadelphia 48, Pa.

SELL or SWAP — 14CPH; yoke; GE flyback; width, linearity indicators; Sarkes or teletron tuners; vertical output oscillator transformers; RCA Synchroguide; power xfmer and filters; above like new. Need VTVM; changer. Morris Levy, 835 Alton Rd., Miami Beach, Fla.

SELL or TRADE — Hallicrafters S53A excellent condition. Will ship prepaid. Best offer over $70 or what have you? Have unused Code Records 45 rpm, alphabet to 8 wpm w/instructions and album. Henry M. Holden, 41-18 Hampton St., Elmhurst 73, N. Y.

WANTED — Gonset 3-30 MC. also BC 314. Charles Leigh, 10 S. Lanning Ave., Hopewell, N. J.

SELL or TRADE — Books, How to Troubleshoot a TV Receiver, Trouble Tracing AC-DC Radio Receivers, Servicing TV in Customer's Home, How to Use Meters by Rider, How to Repair Electrical Appliances and Circuits, Servicing TV Receivers, Pix-o-Fix TV Trouble Finder Guide. All for $3 or trade for asst. of filter capacitors for AC-DC sets. Frank Bou, 47 Oswego Ave., Audubon 6, N. J.

FOR SALE — 2 Electro-Voice 664 Car Dynamic Mikes; E-V's best quality PA Mike, like new $37.50 each, both $70. E. T. Schorle, 3172 Colony Lane, Plymouth Meeting, Pa.

FOR SALE — Radio equipment, good buy for someone starting a business — no packing or mailing. Mrs. G. A. Wright, 107-10 32 Ave., East Elmhurst 69, N. Y.

FOR SALE — Hickok 600 Mutual Conductance Tube tester, good operating condition, $50; C-D BF60 Capacitor Resistor Bridge like new, $25. Prices FOB Floyd Whipkey, 2508 Hess Ave., Wheeling, W. Va.

FOR SALE — Test equipment, 5-AXP4 with cabinet & Unv. yoke, Sams, Supreme TV & radio books, NRI Riders vol. 1, Riders Tell-a-Fault. Fada FM Tuner, Heath-04-Amplifier. Simpson Wattmeter, 6v flash solder gun with transformer & extra tips, etc. George Schalk, 471 W. Saddle River Rd., Ridgewood, N. J.

WANTED — Operations and alignment manual for Bendix MRT-3B Communicator. Advise price. Herb Ailing, 209 Euclid Ave., Byesville, Ohio.

SELL OR SWAP — Clough-Brengle VOM, transmitter with 2E26 in final, plate modulated; Vibrator Pack 6VDC, 6v. battery charger, 11 tube com. receiver. Want Grid-Dip meter, Ant. Rotator. B. Nastoff, 320 W. 56th. Place, Gary, Ind.

FOR SALE — Gonset Linear amp. 500w $150, Match box $35, LP filter 75 ohm $10 all like new; 6-400v generator $15. Pickering Unipoise arm, Monaural, 2 diamond needles (LP and 78) $20. Cook stereo pre amp. $25. Dayes, 29 Charles St., Merrick, L. I., N. Y.

WANTED — 6 BY 5G tubes and Paco test equip. O. Zetlmeier, 1123 Woodycrest Ave., New York 52, N. Y.

WANTED — Metal/Mine Detector-Locator. Anthony Kray, Putney, Vt.

TRADE — Modern Radio Servicing by Ghirardi, Riders Servicing Superhets, 10 different TV Schematics plus service notes for best offer in U.S. Commem. mint stamps. Selcraft, Box 394, Spring Valley, N. Y.

WANTED — Late model FM tuner, Heath FM-4 or equal in good condition and working. State cond. and price. Edwin C. Eisenbeis, 2813 Sheila Drive, Louisville, Ky.

FOR SALE — Globe Citizens Broadcaster CB-100, 4 ft. Diston chain saw, two man, 9 hp $160. James R. Lutz, 4505 Columbus Ave., Sandusky, Ohio.

FOR SALE — Hy-gain 8 element beam $23, kryloned, 45' RG-8/U coax $5, 43' AR22 round rotor wire $1.50 all like new; TV-1000-LP filter $10; 0-3RF ammeter $5, 0-150VAC Simpson meter $8.50, Time-Master $7, Robert Sherman, 8871-20th Ave., Brooklyn 14, N. Y.

WANTED — Alignment information on Navy Receiver CFT-46154-A, a unit of RBA5 equipment, 15 to 600kc. Robert L. Middlestead, 1450 N. W. 91st St., Miami 47, Fla.

FOR SALE — RCA Antennaplex system for Channels 2, 4, and 6. Includes rack mounted power ML-6936, 6 strips ML-6938B, controls, and 4 outlet RCA distribution amplifier. Good cond $250. Noel J. Poux, R1, Titusville, Pa.

FOR SALE — Valuable literature for servicemen, students. Books, mags, correspondence course, servicing, high class parts made for gov't. Send stamp for details. Bargains. John Kadletz, Chatfield, Minn.

TRADE — Radio tubes, parts, ham gear, test equip, QST's, CQ's, radio mags, or cash for souvenirs of Presidential elections — buttons, badges, ribbons, etc. Alan York, 35 Main St., East Hampton, N. Y.

SELL OR SWAP — 16 mm RCA sound movie projector, 16mm movie camera, good used TVs all sizes, trans. radios. Want ham gear receiver, etc. Gerald Manning, 312 Bryant Ave., Dalton, Ga.,

SELL or TRADE — Desco diving gear, complete outfit all in good condition, $110 if picked up. Will trade for good used Geiger counter of comparable value. Write for complete listings. Bill Wider, 1615 Wood St., Elkhart, Ind.

FOR SALE — 47 copies Aerovox, 37 Gen. Radio Experimenter, 31 Hewlett-Packard Journal, $1 each batch, 84 copies C-D Capacitator $2. All for $4. PP. Want. 903 Silver wavemeter with 80 & 40 coils and LM-10 Manual. A. S. Johnson, 67 West 10th St. Hialeah, Fla.

TRADE — Film-o-Tape recorder, good condition, self-contained 115v AC supply, 6 low and 2 high imp. inputs with individual gains, Input and output monitoring, 7X10X17 case. Want HQ129X, SX71 or ? George Maxey, 805 Lincoln Redding, Calif.

WANTED — Both Rider's Radio Manuals from No. 22 and TV manuals from No. 12 up to latest published. Must be in excellent condition with indexes & manuals. LS Radio-TV, 461-3 So. Rd. Poughkeepsie, N. Y.

WANTED — Scott All-Wave 15, Symphony, or Philharmonic Rcvrs, complete or parts, also other ancient gear, send for my list. D. H. Moore, 1485 Bush, San Francisco 9, Calif.

WANTED — Cash paid for used correspondence courses. Send description. Robert E. Wall, Box 141, Byars, Okla.

FOR SALE — Globe Scout 680 factory wired in fine cond $75, S-40 with Heath QF-1 Q-mult and S-meter 70, 15w 6m rig 5763 plate modulated with power supply $16, 6m beam Telrex 3 el $10. Bruce Bouvier, Box 99, Oakland, N. J.

FOR SALE — Riders' TV Manuals 1 thru 26, and radio manuals 1 thru 23 (49 volumes in A-1 cond) make offer. Heath TS4 alignment generator with 10.7 and 4.5 mc crystals $37.50, Hickok videometer $75. All in very good cond. James H. Spencer, 990 Wilmington Terr., Raleigh, N. C.

FOR SALE — BC-191 converted without power supply $20, power supply: 1000 volts at 250 mils, $25, plus other voltage. Bennett Meyer, 145 - 06 34 Ave., Flushing 54, N. Y.

TRADE — Will trade Sprayberry 1959 Radio & TV course for NRI, RCA, or DeVry 1959 Radio & TV course. Fred C. Yaunk, 3108 Avenue H, Fort Madison, Iowa.

WANTED — Stroboconn electronic piano tuner. State price and cond. Franklin Miller, Gambier, Ohio.

FOR SALE — Granco UHF Tuner, Electronic converter model 261, 115v DC in, 115v AC out, 75 watts, assorted cable RG 8/U, 22/U, 58/U, 11/U, & 2-3-4 conductor shielded. Or swap for radio components. A. Gilmore, 50 Edgewater Dr., Framingham, Mass.

WANTED — Tektronic 532 scope with 53/-54E amp or/and 53/54G amp. S. Krsna, NJE Corporation, Kenilworth, N. J.

FOR SALE — Kilowatt final finest construction, 250w modulator, 75w Eldico transmitter, Heath lab signal generator, photo equip, radio & photo magazines. M. Egnitz, 1125 Kirkpatrick St., N. Braddock, Pa.

FOR SALE — Johnson Matchbox cat No. 250-23 10 thru 80 meters, used for one QSO, fine condition for best offer including postage. Jesse Gonzalez, 43 Pacific St., Newark 5, N. J.

WANTED — Chassis for RCA K-105 radio. Steve's Radio Service, Wickes, Ark.

FOR SALE — Complete NRI course "Radio & TV communications," with kits and built-up transmitter $50. M. E. West Rt 2, Lenoir, N. C.

TRADE — Set or American Flyer trains for Dx-40. Will pay difference & shipping of any. Dennis Walsh, 493 Fresno Pl., Magnolia, N. J.

FOR SALE — Zenith transoceanic, like new, $35 or trade for S-38C in working cond. Ronald J. Melancon, Box 422, Cloquet, Minn.

WANTED — Handle for Weller WD-135 soldering gun, state price, color. Livingston Electronics, 9 West Liberty St., Dansville, N. Y.

FOR SALE — Hickok 610A Sweep-marker generator with 4.5 MC crystal. Precision ES500A scope with probes, fine condition, both for $175. Van Nest Radio-TV, 717 Morris Park Ave., Bronx 62, N. Y.

WANTED — Auto radio with speaker for 1956 Mercury (Monterey). State cond, price. Camille Pichette, Jr., 98 Fourth St., Auburn, Maine.

WANTED — RF ammeter with thermocouple, ½ amp (500 ma) full scale reading. State cond, price. H. J. Bankston, Box 171, Fort Walton Beach, Fla.

WANTED — Stromberg-Carlson AR-430 12 watt amplifier in first-class cond. Ozark Radio, 1209 Iowa St., Rolla, Mo.

WANTED — Zenith Power xformer No. 95-1298, must be ok. Schematic with working values and proven circuit, to convert Heath CB-1 to superhet receiver. State price. Space TV Service, 131 Stratford Dr., Houghton Lake 12, Mich.

FOR SALE — Supreme 599 tube and set tester, $30. Hallicrafter S-40 receiver, $40, National NC-156 receiver $30. Cash or trade. Ed Howell, Folly Beach, S. C.

SELL OR TRADE — Triplett 3432 signal generator & 3413 tube tester, GE transistor tester in fine condition. Need 22 rifle, shotgun, sports equip, power saw. Melvin Decker, Bison, Kan.

WANTED — Grid dip meter, Millen 90651, Heath GD-1B or Knight G-30. Must be A-1 cond and reasonably priced. Edwin C. Eisenbeis, 2813 Sheila Dr., Louisville 5, Ky.

WANTED — Wire recorder spools, with or without wire. George F. Marts, 4201 Colvin Dr., St. Louis Co., 23, Mo.

FOR SALE — Heath SG-8 sig. gen. $15. Heath VT-1 vibrator tester, $9, both like new with manuals. R. M. Nelson, Box 425, Dassel, Minn.

FOR SALE — Quantity of surplus Stewart-Warner 20-0-20 ammeters with 2½" dial face, mounting bracket, provision for illumination, perfect, $2.49 each postpaid. Martin Goffe, 1011-44th St., Brooklyn 19, N. Y.

FOR SALE — RDP panadaptor converted to 455 KC with schematic, BC 348 receiver with S-meter, ARC-5 Q-5r with power supply and speaker. J. Leskinen, 33-45 172nd St., Flushing 58, N. Y.

WANTED — NRI Radio TV News and NRI Radio Servicing Diagrams vols. 1 & 2 in good cond. William P. Jarvis, 1214 Fifth Ave., Beaver Falls, Pa.

WANTED — For cash. Sams Photofacts No. 423 to date. State set numbers, cond and price. Earl W. L. Wells, 223 N. Philadelphia St., Shawnee, Okla.

TRADE — Signal Corps tube tester I-177-A and Sextant A-10A, for Hi-Fi turntable. Anthony Caristi, 69 White Pond Rd., Waldwick, N. J.

SELL OR TRADE — Communication test equip, Lomkin 105, $100, and 205A, $175, Link Freq & Dev. Meter, $125, P85501 Motorola testset, $50, Measurement 84 signal generator, 300 to 1000 MC all like new. Don Clork Communication, 99 N. W. Main St., Blackfoot, Idaho.

SWAP — National SW54 receiver in operating cond for good stamp collection or better grade accumulation of stamps. W. G. Milnes, Jr., 27 Becker Ave., Manton 9, R. I.

FOR SALE — Navy PR preamplifier with manual, 5 input channels, master gain control stage and tone control stage. Best offer F.O.B. Leo Friedman, 85 Newman St., Hackensack, N. J.

FOR SALE — Collins 75A-4 receiver, Ser. No. S208 with 3KC mech. filter and inst. book. Like new, $500 F.O.B. Will Herzog, 1445-40th St., N.E., Cedar Rapids, Iowa.

FOR SALE — National NC-88 ham receiver 1 RF and 2 IF stages, $90, Hallicrafters S-38E receiver, both very good cond, $50. Robert F. Leamy, Jr., 335 East 27th St., Erie 5, Pa.

FOR SALE — Pyramid CRA-1 capacitor analyzer with instruction manual and test leads, very good cond. Norelco PT-300 projection TV receiver less cabinet, includes Sams diagram, good condition. James J. Donnelly, Nichols, N. Y.

FOR SALE — Viking Challenger transmitter, 120w CW, 70 watts phone, fine cond, no scratches $100. Harry Morelli Jr., 3141 Sedgwick Ave., Bronx 63, N. Y.

HELP WANTED — Electronic Technicians with 2nd class FCC license, radar endorsement. Mohawk Airlines, Oneida county airport, Utica, N. Y.

SWAP — Special tubes, broadcast equip; microwave test sets and any commercial test equipment. Leo Diamond, 749 West End Ave., New York 25, N. Y.

SELL OR SWAP — DuMont CRO, 208 Esterline Angus AW recorder, General radio 732 dist. & noise meter and het. freq. meter type 616-D. Al Denson, Box 122, Rockville, Conn.

WANTED — Winston 250 dot generator. Have 260 radio, TV tubes, 2 tube caddies, complete coverage of radio & TV 1948 to 1959 with Supreme, 25 Sams, other parts for sale or trade. Arthur Crabb, 7740 Oak St., Kansas City 14, Mo.

WANTED — NRI advanced course in good cond and reasonable, must be complete. L. E. Smith, Rt 1, Trion, Ga.

FOR SALE — Heathkit CB-1 transceiver $40, 12v Heathkit vibrator power supply $8, Kuhn 12v converter for Citizens Band $20, Kuhn auto-n-limiter $5. All very good cond. R. J. Abbott, 25 Margaretta Ct., Staten Island 14, N. Y.

SALE OR TRADE — Simpson 383A capaco meter never used $55. Want 1959 Pyramid condenser checker, new cond, Megacycle meter model 59, Precision 251 sig tracer. W. E. Schwenzer, 3619 Peach St., Erie, Pa.

FOR SALE — Tandberg stereo recording amplifier complete $35, conversion kit with head and playamp $30, Concertone stereohead No. 105241 $25, Viking 75 front panel speed change kits, $3. S. K. Gibson, 108 Greenwood Lane, Waltham 54, Mass.

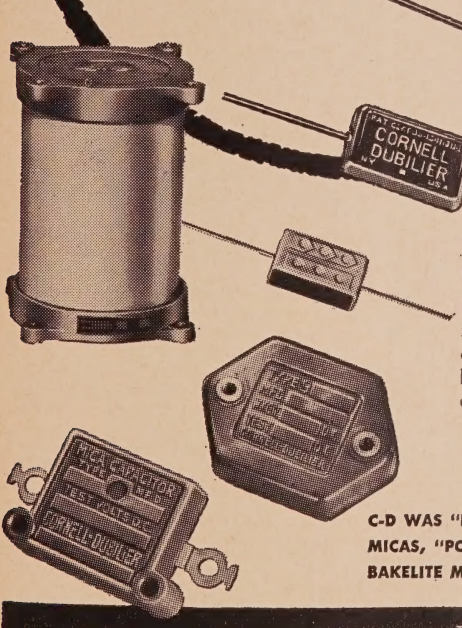
FOR SALE — Novice Weskit BN-1 portable, battery powered, 5w, 80-40 meter transceiver, in good condition, with manual, 90v power supply and cabinet. Make offer. James Sundet, 509 Main St., Breckenridge, Minn.

WANTED — Ham desires 1916 govt. printed Call Book of govt. and amateur call letters of 1916 era. Quote price. Jasper T. Meshaw, 239 Davie Dr., Wilmington, N. C.

Consistently Dependable

Cornell-Dubilier

mica capacitors



They don't just meet ratings: they exceed them!

Other capacitors may look like C-D micas. But there the resemblance ends. Because only C-D's have the built-in extras that are the result of over 50 years of capacitor leadership.

C-D WAS "FIRST" WITH HIGH VOLTAGE TRANSMITTING MICAS, "POSTAGE-STAMP" MICAS, "SILVERED" MICAS, BAKELITE MOLDED MICAS.

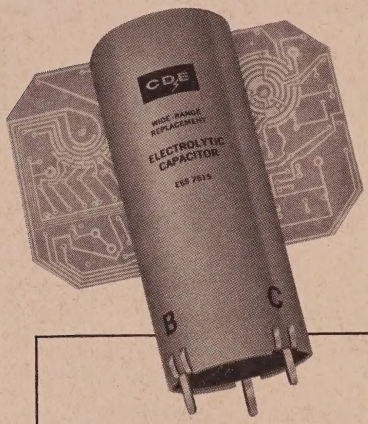
THERE ARE MORE C-D CAPACITORS IN USE TODAY THAN ANY OTHER MAKE

CORNELL DUBILIER *Capacitors*

CORNELL-DUBILIER

WIDE RANGE

ELECTROLYTIC CAPACITOR TYPE ESS-7515



SPECIFICATIONS

Case Size — 1" Dia. x 2½" Long
Overall — 1" Dia. x 2¾" Long
Printed Board Mounting Lugs

DUAL SECTION UNIT:

Lug A — Common Negative
Lug B — 40-80 Mfd. 150 WVDC
Lug C — 30-60 Mfd. 150 WVDC

Here's probably the most versatile SINGLE UNIT (2 section) Electrolytic Capacitor ever to come to the aid of the Radio and TV Service Technician.

This compact, ESS-7515, cardboard sleeved single unit provides an EXACT electrical and mechanical replacement for 8

Original Standard 150 WVDC Capacitors

as used principally in printed circuit home radio receivers . . .

50-30 Mfd.	**80-40 Mfd.**
70-30 Mfd.	**50-50 Mfd.**
75-30 Mfd.	**70-50 Mfd.**
60-40 Mfd.	**80-50 Mfd.**

In addition, the versatility of the ESS-7515 makes it an ideal replacement for many combinations of capacitance, within its ratings, beyond the 8 mentioned above. For example:

It will replace—any SINGLE section unit rated between 40 and 80 Mfd. at 150 WVDC; *or* — any SINGLE section unit rated between 30 and 60 Mfd. at 150 WVDC; *or* — any SINGLE section unit rated between 30 and 140 Mfd. at 150 WVDC *and many more.*

The ESS-7515 is designed especially for printed board mounting. The mounting lugs can also serve as solder terminals for conventional sub-chassis capacitor replacements.

A modest stock of ESS-7515's provides an ever-ready answer for a multitude of service replacements. **List Price $2.00**

at all Authorized CDE Distributors *NOW!*

CDE

CORNELL-DUBILIER ELECTRIC CORP.
AFFILIATED WITH FEDERAL PACIFIC ELECTRIC COMPANY
SOUTH PLAINFIELD, NEW JERSEY

Printed in U.S.A.